DEVELOPMENT OF AN APPROACH TO ASSESS NO-EFFECT DOSES AND DOSE RATES FOR CULTIVATED PLANTS

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In recent years many efforts have been undertaken to develop a system of radiation protection for non-human biota. Agrarian ecosystems are of special concern from the viewpoint of establishing safe levels of radiation impact on the environment since, first, their contamination can affect human health via radionuclide uptake with food, and second, agroecosystems are ones of the most sensitive to a number of environmental impacts including ionising radiation. Up to now there are no guidelines on setting any limitations to directly protect agrarian ecosystems from negative effect of radiation. The aim of this work is to develop methods for an assessment of critical doses and dose rates that can result in significant radiation-induced effects in agrocenoses. This is realized on an example of cultivated plants which are one of the main components of agroecosystems since cultured plants not only contribute essentially to food production but also fulfill an important ecological function in agrarian biocenosis.

Available information on dose dependences in such umbrella endpoints as reproductive potential, survival, morbidity, alterations in morphological and biochemical processes, genetic effects in crops, vegetables, fruit trees, etc are gathered from papers issued mainly in Russian scientific press during last 50 years. Data are maintained as database in MS Access that contains about 10000 records at the moment; the work is ongoing. Quantitative data are collected for about 60 species of cultivated plants. As no-effect values, there are considered doses producing 50% changes of biological effect at acute impact (ED_{50}), or dose rates resulting in 10% changes at chronic exposure of plants (EDR_{10}). No-effect doses for different species and their groups (crops, legumes, vegetables, etc) are calculated from dose-effect dependences obtained with the corresponding data sets. Primary data are assesed for their quality according to several criteria. Three models (linear, logariphmic, and logistic) are tested for an applicability to fit a dose-effect dependence taking account of their goodness-of-fit and robustness of ED_{50} and EDR_{10} estimates. The no-effect doses and dose rates for agrocenosis estimated from available information on reproduction and survival are presented. It is discussed to what extent critical radiotoxicity values can depend on a type of model chosen to fit dose dependence and quality of primary data.